

Underwriters Laboratories Inc.
1285 Walt Whitman Road
Melville, New York 11747-3081
(516) 271-6200

**Report of Measurements
of Electromagnetic Compatibility Testing**

Test Report File No. : **BP7169** Date of issue: February 3, 1999
Applicant : Applied Wireless Identifications Group Inc.
Model / Serial No. : Sentinal-Prox SP-6820
Product Type : Doorframe Proximity Reader
Power Supply : 5Vdc and 12Vdc
Manufacturer : Same as Applicant
License holder : Same as Applicant
Address : 382 Route 59 Section 292
: Monsey, NY 10952
Test Result : ☒ **Positive** ☐ **Negative**
Test Project Number : 98ME50398
References(s)

FCC ID: XXXSP6820

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1.0 GENERAL - Product Description

The device under test is a Doorframe Proximity Reader which operates at 125kHz and is powered by a dc source. This Radio Frequency Identification (RFID) reader or proximity reader uses radio frequency to identify, locate and track people and objects that carry the appropriate transponders. Proximity reader can work in none line-of-sight situations and in darkness, bright sun light or through dirt, grimes and smudges.

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Project Number: 98ME50398
Model Number: Sentinel-Prox SP-6820
FCC ID: XXXSP6820

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1.1 Device Configuration During Test

The EUT was configured as a stand-alone device. Tests were performed with a 5Vdc and a 12Vdc supply connected to the EUT.

1.1.1 Deviations from ANSI C63.4 Standard Test Set-up

☒ None

☐ As described below:

1.2 Device Modifications Necessary for Compliance

☒ N/A

☐ As described below:

Environmental conditions in the lab:

Temperature:	<u>Range</u> 20-25°C
Relative Humidity	30 - 60 %
Atmospheric pressure	680 - 1060 mbar

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2.0 EMISSIONS TEST REGULATIONS:

- | | | |
|---|---|----------------------------------|
| ☐ EN 50081-1 /1992 | ☐ Group 1 | ☐ Group 2 |
| ☐ EN 50081-2 /1993 | ☐ Class A | ☐ Class B |
| ☐ EN 55011 / 3.1991 | | |
| ☐ EN 55013 / 6.1990 | ☐ Household appliances and similar | |
| ☐ EN 55014 / 2.1987 | ☐ Portable tools | |
| | ☐ Semiconductor devices | |
|
 | | |
| ☐ EN 55014 / 12.1993 | ☐ Household appliances and similar | |
| | ☐ Portable tools | |
| | ☐ Semiconductor devices | |
|
 | | |
| ☐ EN 55015 / 1993 | | |
| ☐ EN 55022 / 4.1987 | ☐ Class A | ☐ Class B |
| ☐ EN 55020 / 1994 | | |
| ☐ EN60555-2/1987, EN61000-3-2, 1995 | | |
| ☐ EN60555-3/1987, EN61000-3-3, 1995 | | |
| ☐ VCCI | ☐ Class 1 | ☐ Class 2 |
| ☒ FCC Part, 15, Subpart B | ☒ Class A | ☐ Class B |
| ☒ FCC Part , 15, Subpart C, Paragraph 15.209. | | |
| ☐ FCC Part 18 | | |
| ☐ CISPR 11 (1990) | | |
| ☐ CISPR 14 (1993) | | |
| ☐ CISPR 22 | | |
| ☐ DENTORI | | |
| ☐ AS3548 | | |
| ☐ (OTHER) _____ | | |

2.1 EUT OPERATION MODE - EMISSIONS TESTS:

- ☐ Standby
- ☐ Test program (H-Pattern)
- ☐ Test program (color bar)
- ☐ Test program (customer specific)
- ☐ Practice operation
- ☒ Normal operation Mode: continuous sense for entry badge.
- ☒ As per manufacturer's instructions
- ☐ other

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2.1.1 Conducted Emissions Tests:

☐ Test Applicable ☒ Test Not Applicable

2.1.2 Conducted Click Emissions Tests:

☐ Test Applicable ☒ Test Not Applicable

2.2.1 Reserved for Future Use

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2.2.2 Radiated Emissions Test (10 Meter Semi-Anechoic Chamber):

☒ Test Applicable ☐ Test Not Applicable

All Data Pages located in Appendix A.

120kHz-30MHz Using Magnetic Loop Antenna

The measurement antenna distance ☒ 3 ☐ 10 meters from the EUT.

30MHz-1000MHz

The measurement antenna distance ☐ 3 ☒ 10 meters from the EUT.

Tests were performed on the transmitter in accordance with the limitations set forth by CFR47 FCC Part 15, Subpart B, Class A, Paragraph 15.209 and tested in accordance with the test procedures and methodologies in ANSI C63.4: 1992.

The EUT was checked throughout the frequency band 120KHz to 100MHz. The transmitter operated at 125KHz. The allowable field strength limits in accordance with 15.209 were applied to the frequency. All other emissions were tested in accordance with the general limitations in 15.209.

From 120KHz to 30MHz, measurements were made at a distance of 3 meters. The limit was adjusted using the 40dB/decade limit extrapolation method.

Test equipment used for final radiated emissions tests:

☒	HP - 8566B	Hewlett-Packard	Spectrum Analyzer	Equipment No.: ME5-589
☒	HP - 85662A	Hewlett-Packard	Analyzer Display	Equipment No.: ME5-590
☒	HP - 85650A	Hewlett-Packard	Quasi-Peak Adapter	Equipment No.: ME5-591
☒	HP - 85685A	Hewlett-Packard	Preselector	Equipment No.: ME5-588
☐	NM- 17/27B	Carnel Labs	Field Intensity Meter	Equipment No.: ME5A-054
☐	CCA7	Carnel Labs	CISPR Quasi-peak Adapter	Equipment No.: ME5A-053
☐	R3261C	Advantest	Spectrum Analyzer	Equipment No.: ME5A-228
☐	R3551	Advantest	Pre-Selector	Equipment No.: ME5A-229

Test Accessories:

☒	6507	EMCO	Active Loop Antenna	Equipment No.: ME5A-288
☐	94455-1	Ailtech	Biconnical Antenna	Equipment No.: ME5-439
☐	3146	EMCO	Log Periodic Antenna	Equipment No.: ME5-451
☐	3146	EMCO	Log Periodic Antenna	Equipment No.: ME5-811
☒	3142	EMCO	BiconiLog Antenna	Equipment No.: ME5A-436
☐	3142	EMCO	BiconiLog Antenna	Equipment No.: ME5A-261

2.2.3 RFI Power Measurements:

☐ Test Applicable ☒ Test Not Applicable

2.2.4 Harmonic Disturbances:

☐ Test Applicable ☒ Test Not Applicable

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2.3 EMISSIONS TEST RESULTS

☐ Conducted Emissions

☐ Voltage(Section 2.1.1)	☐ MET	☐ NOT MET
☐ Current(Section 2.1.1)	☐ MET	☐ NOT MET
☐ Clicks(Section 2.1.2)	☐ MET	☐ NOT MET

☒ Radiated Emissions(Section 2.2.2)	☒ MET	☐ NOT MET
---	---	----------------------------------

☐ RFI Power(Section 2.2.3)	☐ MET	☐ NOT MET
---	------------------------------	----------------------------------

☐ Harmonic Disturbances

☐ Steady State(Section 2.2.4)	☐ MET	☐ NOT MET
☐ Fluctuating(Section 2.2.4)	☐ MET	☐ NOT MET

The tractability of the measurements contained in this report is achieved by the use of calibrated equipment which is traceable back to NIST.

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3.0 IMMUNITY TEST REGULATIONS:

- ☒ NOT APPLICABLE
- ☐ EN50082-1:1992
- ☐ EN50082-2:1995
- ☐ EN55104 : 1995
- ☐ FDA - Reviewer Guide
- ☐ Bellcore GR-1089, Core
- ☐ IEC 601-1-2

In accordance with:

- | | | |
|--------------------------------------|--|---------------------------------|
| ☐ IEC 801-2, | ☐ IEC 1000-4-2 | Electrostatic Discharge (ESD) |
| ☐ IEC 801-3, | ☐ ENV50140 | RF Immunity |
| ☐ IEC 801-4, | ☐ IEC 1000-4-4 | Electrical Fast Transient (EFT) |
| ☐ IEC 801-5, | ☐ IEC 1000-4-5 | Surge (Lighting) |
| ☐ IEC 801-6, | ☐ ENV50141 | Conducted Immunity |
| ☐ IEC 801-11, | ☐ IEC 1000-4-11 | Voltage Dips and Interruptions |

3.1 EUT OPERATION MODE - IMMUNITY TESTS:

- ☐ Standby
- ☐ Test program (H-Pattern)
- ☐ Test program (color bar)
- ☐ Test program (customer specific)
- ☐ Practice operation
- ☐ Normal operating Mode:
- ☐ As per manufacture's instructions

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3.1.1 Electrostatic Discharge (ESD) Test:

☐ Test Applicable ☒ Test Not Applicable

3.1.2 Radiated Field (RF Immunity) Test:

☐ Test Applicable ☒ Test Not Applicable

3.1.3 Electrical Fast Transient (EFT)/Burst test:

☐ Test Applicable ☒ Test Not Applicable

3.1.4 Voltage Surge Test:

☐ Test Applicable ☒ Test Not Applicable

3.1.5 Conducted Immunity Test:

☐ Test Applicable ☒ Test Not Applicable

3.1.6 Voltage Dips and Interruptions:

☐ Test Applicable ☒ Test Not Applicable

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4.0 SUMMARY:

The equipment under test has

☒ met the technical requirements as defined under section(s) ☒ 2.0 and ☐ 3.0

☐ not met the technical requirements as defined under section(s) ☐ 2.0 and ☐ 3.0.

Test Start Date: 12/8/98

Test Completion Date: 12/22/98

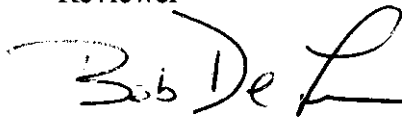
- UNDERWRITERS LABORATORIES, INC. -

Project Engineer



Bernie Papocchia (Ext.23294)
EMC Senior Engineering Associate
International EMC Services
Engineering Services 3014AMEL

Reviewer

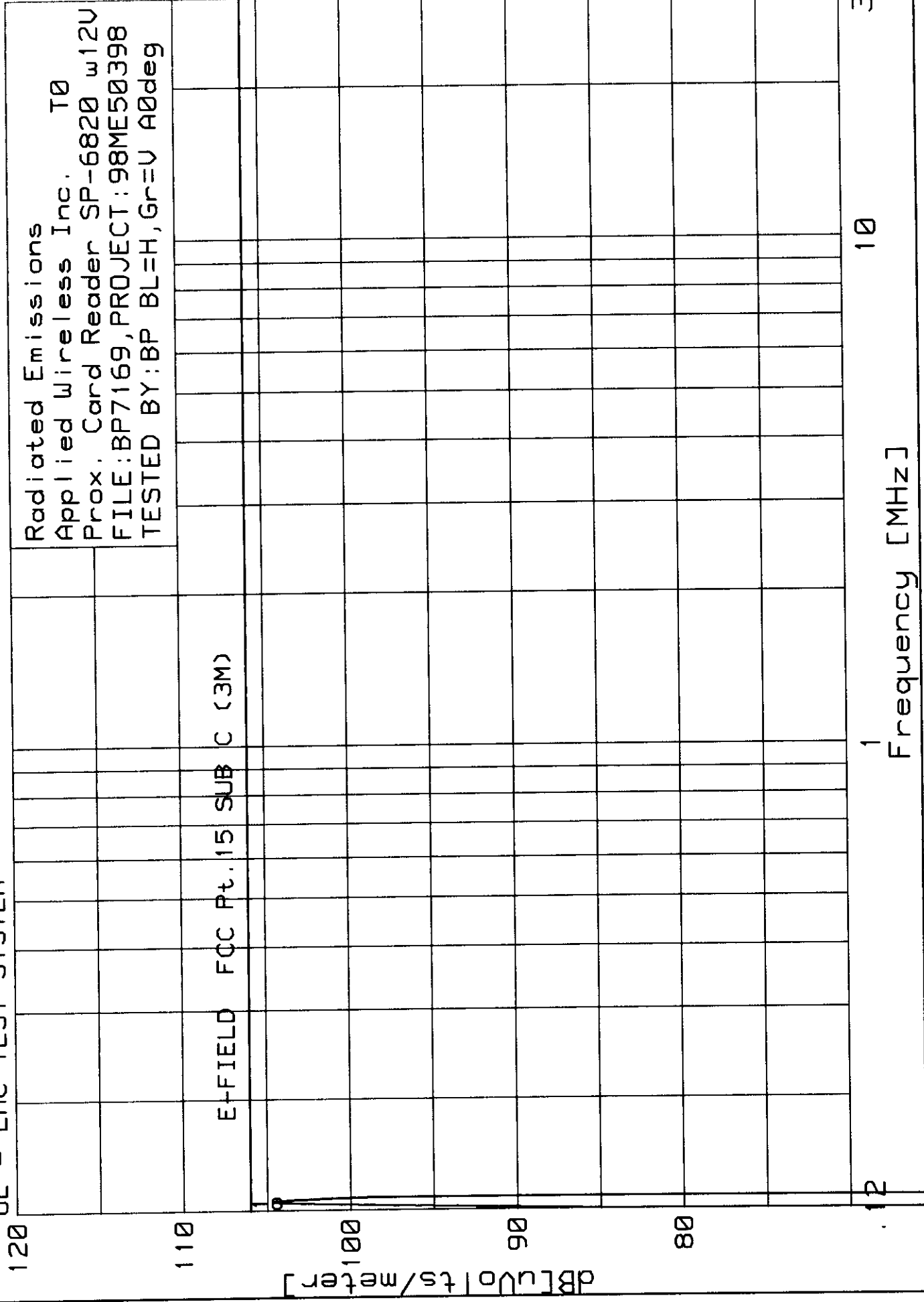


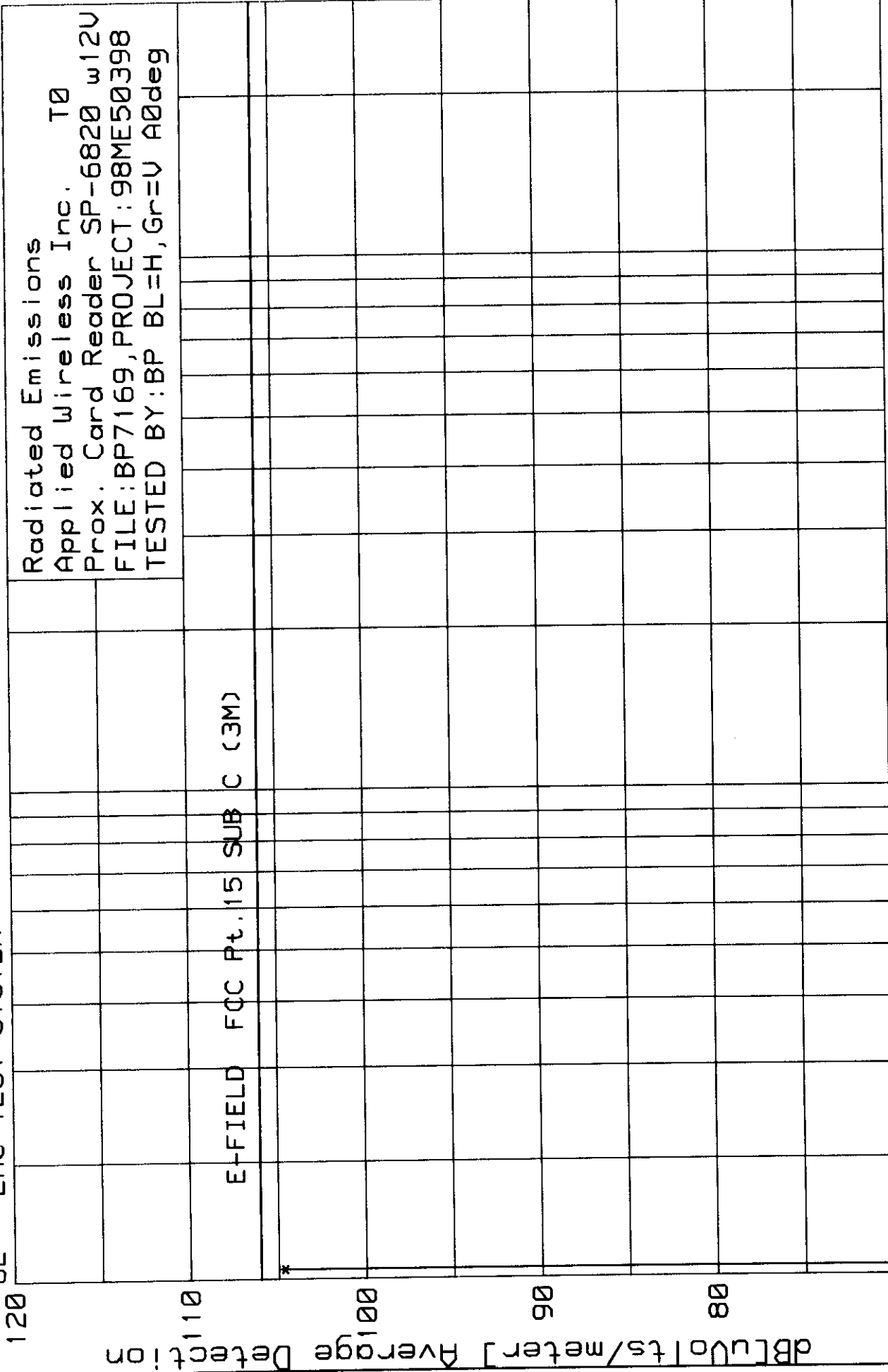
Bob DeLisi (Ext.22452)
EMC Engineering Team Leader
International EMC Services
Engineering Services 3014AMEL

APPENDIX A

EMISSIONS TEST DATA

1. ☐ Conducted Emissions ☐ voltage ☐ current
 - ☐ Peak traces, Data Pages A___ and/through A___
 - ☐ Quasi-Peak traces, Data Pages A___ and/through A___
 - ☐ Average traces, Data Pages A___ and/through A___
☐ Discontinuous Interference (Clicks)
 - ☐ No clicks exceeded the steady state quasi-peak limit
 - ☐ Clicks exceeded the steady state quasi-peak limit. The limit was adjusted to _____ dB and no clicks exceeded the adjusted limit.
 - ☐ Clicks exceeded the adjusted limit. See Data Page A___ for details.
2. ☒ Radiated Emissions
 - ☒ Peak traces, Data Pages A1, A4, A7, A10 and A13.
 - ☒ Quasi-Peak traces, Data Page A14.
 - ☒ Average trace Data, Data Pages A2, A5, A8 and A11.
 - ☒ Average Data, Data Pages A3, A6, A9 and A12.
 - ☒ Peak Data, Data Pages A15 and A16.
3. ☐ RFI Power Measurements
 - ☐ Peak traces, Data Pages A___ and/through A___
 - ☐ Quasi-Peak traces, Data Pages A___ and/through A___
 - ☐ Average Traces, Data Pages A___ and/through A___
4. ☐ Harmonic Disturbances
 - ☐ Steady State Harmonics, Data Pages A___ and/through A___
 - ☐ Fluctuating Harmonics, Data Pages A___ and/through A___
 - ☐ Changing Voltage, Data Pages A___ and/through A___





Radiated Emissions
 Applied Wireless Inc. T0
 Prox. Card Reader SP-6820 w12V
 FILE:BP7169,PROJECT:98ME50398
 TESTED BY:BP BL=H,Gr=V A0deg

E-FIELD FCC Pt. 15 SUB C (3M)

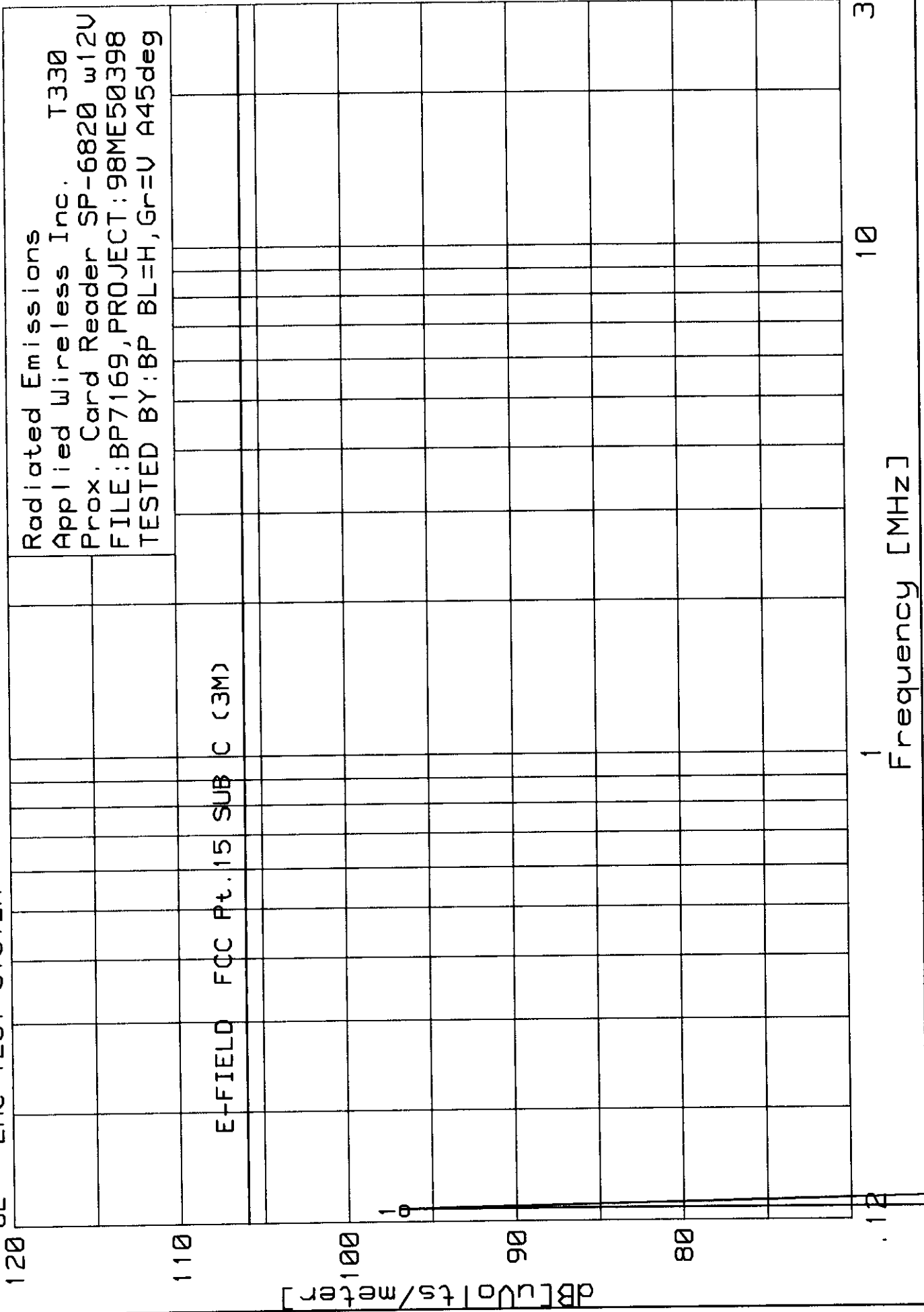
Frequency [MHz]

UL - EMC TEST SYSTEM

Date Tested: 21 Dec 1998
07:25:20Applied Wireless Inc. T0
Prox. Card Reader SP-6820 w12V
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,Gr=V A0degTEST REQUIREMENTS: Radiated Emissions
RECEIVER : Hewlett-Packard Spectrum Analyzer, Model HP8566B
DETECTION MODE : Average
BANDWIDTH : 200Hz for measurements 9kHz to 150kHz
: 10kHz for measurements 150kHz to 30MHz
: 100kHz for measurements above 30MHz

TEST	METER	GAIN/LOSS	TRANSDUCER	LEVEL	LIMITS:	1	2	3	4
FREQUENCY	READING	FACTOR	FACTOR						dB[uVolts/meter]
[MHz]	[dB(uV)]	[dB]	[dB]						
=====									
.12533	87.9	.2	16.6	104.7	106	N/A	N/A	N/A	

LIMIT 1 E-FIELD FCC Pt.15 SUB C (3M)
LIMIT 2 NONE
LIMIT 3 NONE
LIMIT 4 NONE



Radiated Emissions

Applied Wireless Inc. T330

Prox.: Card Reader SP-6820 w12V

FILE:BP7169,PROJECT:98ME50398

TESTED BY:BP BL=H,Gr=V A45deg

E-FIELD FCC Pt. 15 SUB C (3M)

✱

90

80

12

1

10

30

Frequency [MHz]

Date Tested: 21 Dec 1998
07:44:31

Applied Wireless Inc. T330
Prox. Card Reader SP-6820 w12V
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,Gr=V A45deg

TEST REQUIREMENTS: Radiated Emissions

RECEIVER : Hewlett-Packard Spectrum Analyzer, Model HP8566B
DETECTION MODE : Average
BANDWIDTH : 200Hz for measurements 9kHz to 150kHz
: 10kHz for measurements 150kHz to 30MHz
: 100kHz for measurements above 30MHz

TEST	METER	GAIN/LOSS	TRANSDUCER	LEVEL	LIMITS:	1	2	3	4
FREQUENCY	READING	FACTOR	FACTOR						
[MHz]	[dB(uV)]	[dB]	[dB]						
.1275	85.9	.2	16.6	102.7	106	N/A	N/A	N/A	N/A

LIMIT 1 E-FIELD FCC Pt.15 SUB C (3M)
LIMIT 2 NONE
LIMIT 3 NONE
LIMIT 4 NONE

Radiated Emissions
Applied Wireless Inc. T330
Prox. Card Reader SP-6820 w12V
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,Gr=V A90deg

E-FIELD FCC Pt. 15 SUB C (3M)

dB[uo]ts/meter]

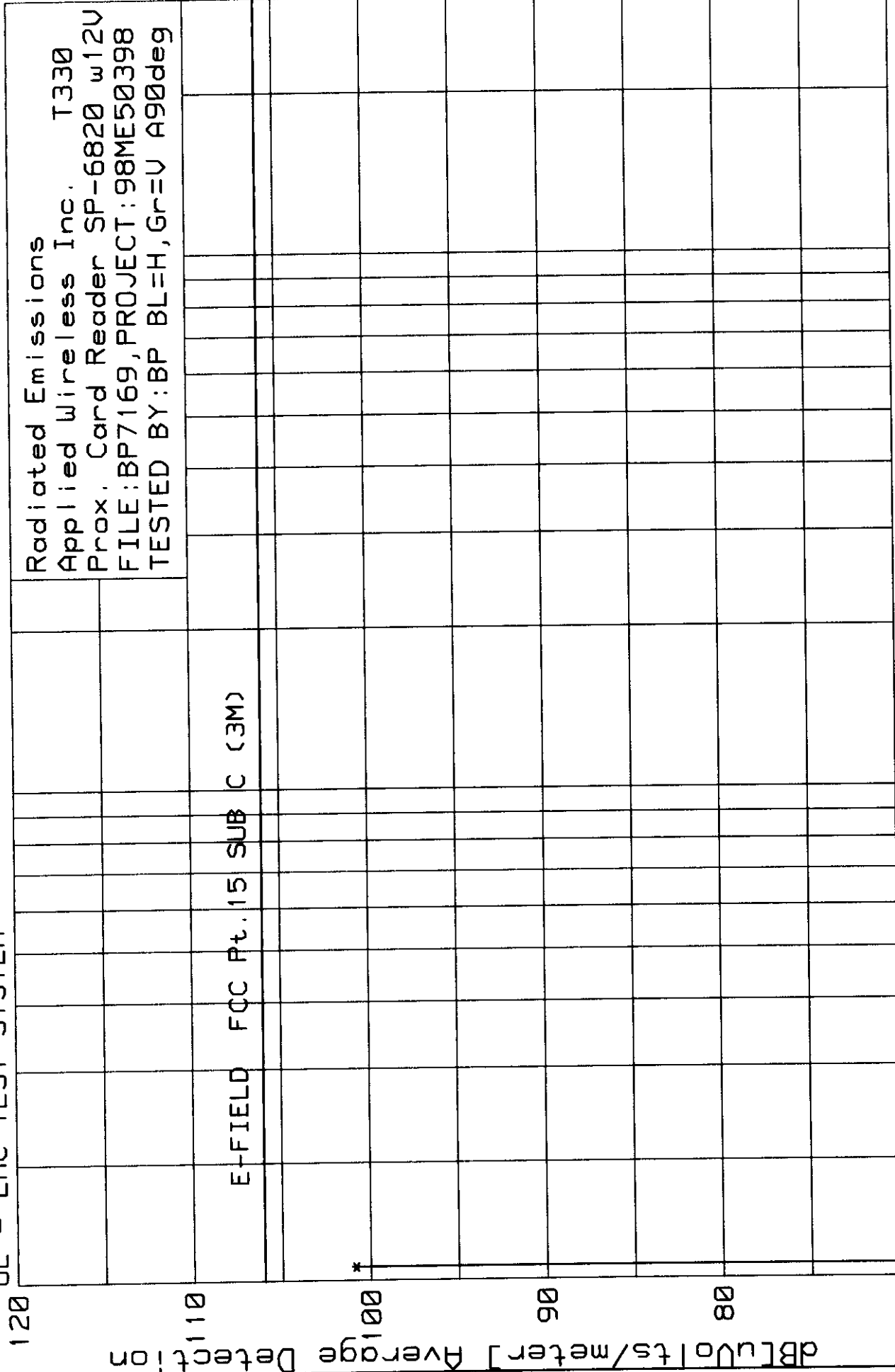
30

10

1

.12

Frequency [MHz]



30

10

12

Date Tested: 21 Dec 1998
07:59:16

Applied Wireless Inc. T330
Prox. Card Reader SP-6820 w12V
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,Gr=V A90deg

TEST REQUIREMENTS: Radiated Emissions

RECEIVER : Hewlett-Packard Spectrum Analyzer, Model HP8566B
DETECTION MODE : Average
BANDWIDTH : 200Hz for measurements 9kHz to 150kHz
: 10kHz for measurements 150kHz to 30MHz
: 100kHz for measurements above 30MHz

TEST	METER	GAIN/LOSS	TRANSDUCER	LEVEL	LIMITS:	1	2	3	4
FREQUENCY	READING	FACTOR	FACTOR						
[MHz]	[dB(uV)]	[dB]	[dB]						
=====									
.1275	84.1	.2	16.6	100.9	106	N/A	N/A	N/A	N/A

LIMIT 1 E-FIELD FCC Pt.15 SUB C (3M)
LIMIT 2 NONE
LIMIT 3 NONE
LIMIT 4 NONE

Radiated Emissions
 Applied Wireless Inc. T212
 Prox. Card Reader SP-6820 w12V
 FILE:BP7169,PROJECT:98ME50398
 TESTED BY:BP BL=H,Gr=V A135deg

E-FIELD FCC Pt. 15 SUB C (3M)

dB[μV/meter]

30

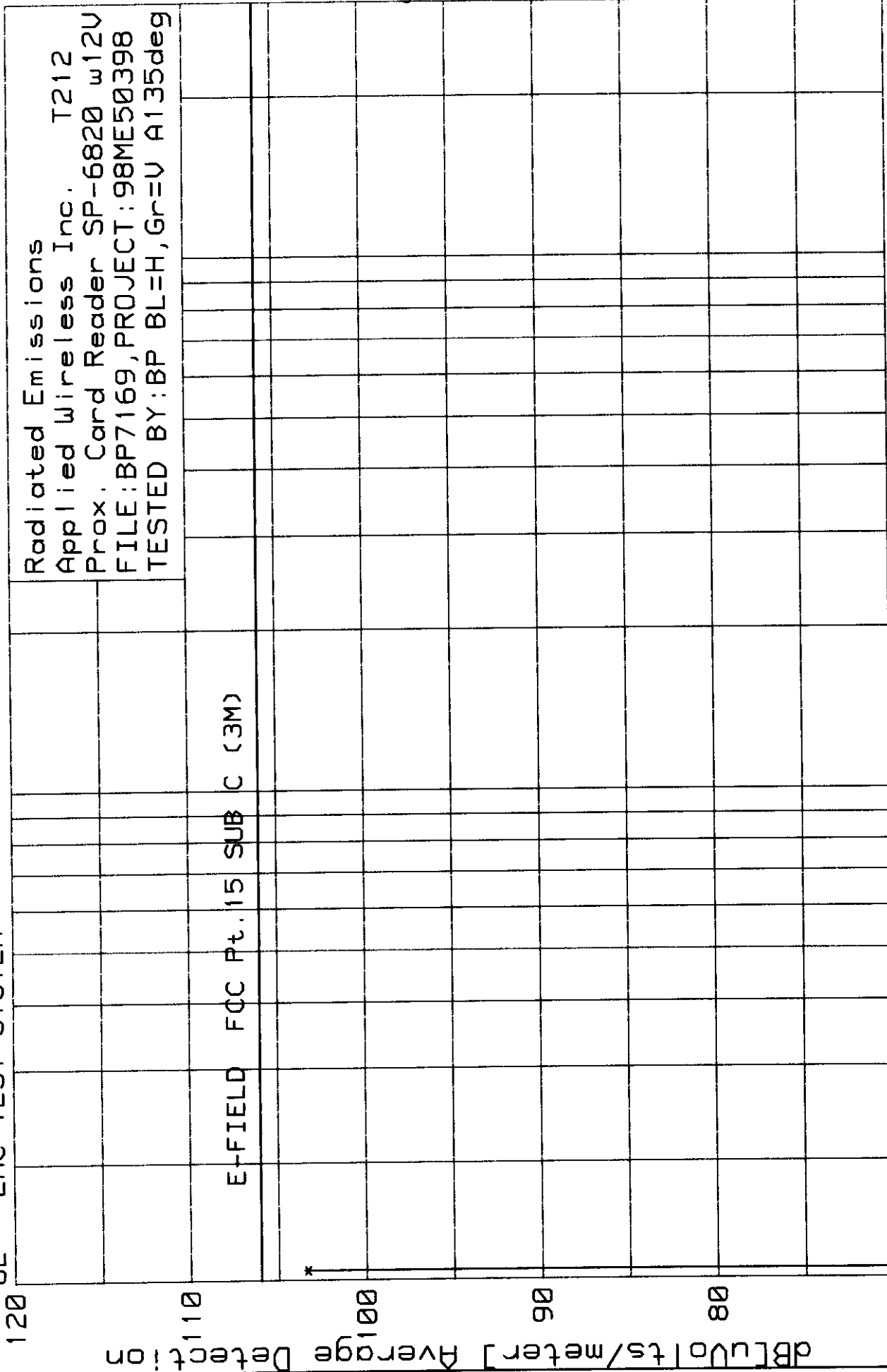
10

1

12

Frequency [MHz]





Radiated Emissions
 Applied Wireless Inc. T212
 Prox. Card Reader SP-6820 w12V
 FILE:BP7169,PROJECT:98ME50398
 TESTED BY:BP BL=H,Gr=V A135deg

30

10

1

.12

Frequency [MHz]

Date Tested: 22 Dec 1998
06:27:02

Applied Wireless Inc. T212
Prox. Card Reader SP-6820 w12V
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,Gr=V A135deg

TEST REQUIREMENTS: Radiated Emissions

RECEIVER : Hewlett-Packard Spectrum Analyzer, Model HP8566B
DETECTION MODE : Average
BANDWIDTH : 200Hz for measurements 9kHz to 150kHz
: 10kHz for measurements 150kHz to 30MHz
: 100kHz for measurements above 30MHz

TEST	METER	GAIN/LOSS	TRANSDUCER	LEVEL	LIMITS:	1	2	3	4
FREQUENCY	READING	FACTOR	FACTOR						
[MHz]	[dB(uV)]	[dB]	[dB]						
.12526	86.6	.2	16.6	103.4	106	N/A	N/A	N/A	N/A

LIMIT 1 E-FIELD FCC Pt.15 SUB C (3M)
LIMIT 2 NONE
LIMIT 3 NONE
LIMIT 4 NONE

Radiated Emissions
Applied Wireless Inc.
Prox. Card Reader SP-6820 w/12V
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BLUE=H, GREEN=U

FCC PT15 CLASS A-RADIATED(10m)

dB[uV/meter]

Frequency [MHz]

80

60

40

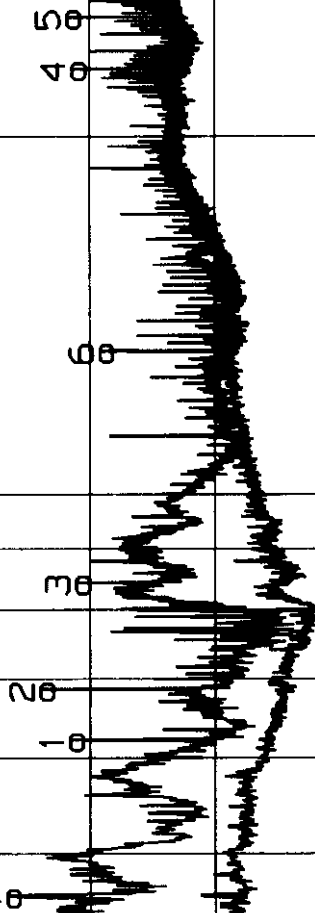
20

0

30

100

1000



Issued: 2/3/99

Date Tested: 18 Dec 1998
08:41:10

Applied Wireless Inc.
Prox.Card Reader SP-6820 w/12V
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BLUE=H,GREEN=V

DATA	TEST	METER GAIN/LOSS	TRANSDUCER	LEVEL	LIMITS:1	2	3	4
POINT	FREQUENCY	READING	FACTOR	FACTOR	dB[uVolts/meter]			
[No.]	[MHz]	[dB(uV)]	[dB]	[dB]				
1	46.04613	23.4	.4	12.7	36.5	39.0	0.0	0.0
Azimuth : 112 Height : 98 V					Margin [dB]	-2.5	---	---

H - indicates horizontal antenna polarization.
V - indicates vertical antenna polarization.

LIMIT 1 : FCC PT15 CLASS A-RADIATED(10m)
LIMIT 2 : NONE
LIMIT 3 : NONE
LIMIT 4 : NONE

Date Tested: 18 Dec 1998

08:41:10

Applied Wireless Inc.

Prox.Card Reader SP-6820 w/12V

FILE:BP7169,PROJECT:98ME50398

TESTED BY:BP BLUE=H, GREEN=V

MARK TRACE - POSITIONS

MARKER NO.	TEST FREQUENCY	LEVEL	LIMIT:1 dB[uVolts/meter]	2	3	4	TABLE AZIMUTH(deg)	TOWER HEIGHT (cm)
1	62.1991	31.4 pk	39	N/A	N/A	N/A	0	400 V
2	68.6051	33.8 pk	39	N/A	N/A	N/A	288	98 V
3	84.3169	30.9 pk	39	N/A	N/A	N/A	252	98 V
4	227.8134	31.2 pk	46.4	N/A	N/A	N/A	166	98 V
5	251.8298	31.6 pk	46.4	N/A	N/A	N/A	307	98 V
6	131.9243	29 pk	43.5	N/A	N/A	N/A	0	400 H
7	46.0152	36.5 pk	39	N/A	N/A	N/A	360	301 V

pk - Peak detector

QP - Quasi-peak detector

LIMIT 1 : FCC PT15 CLASS A-RADIATED(10m)

LIMIT 2 : NONE

LIMIT 3 : NONE

LIMIT 4 : NONE

UL - EMC TEST SYSTEM

Date Tested: 18 Dec 1998
08:41:10

Applied Wireless Inc.
Prox.Card Reader SP-6820 w/12V
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BLUE=H,GREEN=V

MKR	TEST	METER	GAIN/LOSS	TRANSDUCER	LEVEL	LIMIT:1	2	3	4
NO.	FREQUENCY	READING	FACTOR	FACTOR					
	[MHz]	[dB(uV)]	[dB]	[dB]					
1	62.1991	19.9 pk	.5	11	31.4	39	N/A	N/A	N/A
2	68.6051	23.8 pk	.5	9.5	33.8	39	N/A	N/A	N/A
3	84.3169	23.1 pk	.6	7.2	30.9	39	N/A	N/A	N/A
4	227.8134	14.1 pk	.9	16.2	31.2	46.4	N/A	N/A	N/A
5	251.8298	14.2 pk	.9	16.5	31.6	46.4	N/A	N/A	N/A
6	131.9243	15.4 pk	.7	12.9	29	43.5	N/A	N/A	N/A
7	46.0152	23.4 pk	.4	12.7	36.5	39	N/A	N/A	N/A

pk - Peak detector
qp - Quasi-peak detector
av - Average detector
tm - Trace Math Result

LIMIT 1 : FCC PT15 CLASS A-RADIATED(10m)
LIMIT 2 : NONE
LIMIT 3 : NONE
LIMIT 4 : NONE

File Number: BP7169

Project Number: 98ME50398

Model Number: Sentinal-Prox SP-6820

FCC ID: XXXSP6820

Issued: February 3, 1999

APPENDIX C

SAMPLE CALCULATIONS

APPENDIX C

Sample Calculations

Radiated Emissions Limit conversion from $\mu\text{V/m}$ to $\text{dB}\mu\text{V/m}$
(limits in accordance with paragraph 15.109)

$$\text{Radiated Emissions Limit (dB}\mu\text{V/m)} = 20 * \log (\mu\text{V/m})$$

$$\text{Radiated Emissions Limit (dB}\mu\text{V/m)} = 20 * \log (90)$$

$$\text{Radiated Emissions Limit (dB}\mu\text{V/m)} = 39.1$$

Radiated Emissions test data obtained during measurements.

$$\text{Field Strength (dB}\mu\text{V/m)} = \text{Measured field strength (dB}\mu\text{V/m)} + \text{Antenna Factor (dB)} + \text{Cable Factor (dB)}$$

$$\text{Field Strength (dB}\mu\text{V/m)} = 23.4 \text{ dB}\mu\text{V/m} + 12.7 \text{ dB} + 0.4 \text{ dB}$$

$$\text{Field Strength (dB}\mu\text{V/m)} = 36.5$$

Radiated Emissions Limit conversion from $\mu\text{V/m}$ to $\text{dB}\mu\text{V/m}$ and 40dB/decade
(limits in accordance with paragraph 15.209)

Radiated Emission Limits; General Requirements

$$\text{Frequency between 0.009-0.490 MHz} \quad 2400/F(\text{kHz}) \text{ at 300 meters} = \text{Field Strength in } \mu\text{V/meter}$$

$$125 \text{ kHz} \quad 2400/(125) \text{ at 300 meters}$$

$$\text{Radiated emissions at 125 kHz at 300 meters} = 19.2 \mu\text{V/meter}$$

$$\text{dB}\mu\text{V/m} = 20 * \log (19.2 \mu\text{V/m})$$

$$\text{dB}\mu\text{V/m} = 25.67 \text{ at 300 meters}$$

40dB/decade

$$300 \text{ meters to 3 meters} = 80 \text{ dB}$$

$$\text{Radiated Emissions Limit} = \text{dB}\mu\text{V/m} + \text{dB}$$

$$25.66 + 80$$

$$105.66 \text{ dB}\mu\text{V/m}$$